

Appl. No. 10/667,974
Amendment dated: March 30, 2006
Reply to OA of: October 31, 2005

Amendments to the Drawings:

The attached sheets of drawings include changes to Figures 1 and 2. These sheets, which include Figure 1 and Figure 2, respectively, replace the original sheets and any previously filed replacement sheets including Figures 1 and 2

Attachment: Replacement Sheets

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REMARKS

This is in response to the Official Action of October 31, 2005.

Applicants first note the objection to the Substitute Specification filed on October 6, 2005 set forth in the Official Action. The Official Action notes that the clean copy of the Substitute Specification submitted contains amendments, i.e., each use of the word "Embodiment" on page 10 has been replaced with the word "Example". Accordingly, Applicants submit herewith a proper copy of the clean version of the Substitute Specification that does not contain these markings. Accordingly, Applicants respectfully request that this objection to the Specification be withdrawn.

Applicants also note the amendments made to the drawings in this response. Specifically, Applicants have discovered that the width of the catalyst illustrated in Figures 1 and 2 is labeled as "About 2 mm". However, as clearly supported by the specification as originally, filed, the catalyst is on a nanometer level and therefore Figures 1 and 2 should indicate that the width of the catalyst is "About 2 nm". The replacement sheets included herewith make this correction.

With respect to the provisional obviousness-type double patenting rejection of claims 1-3, 5-7, 10, 12 and 14-17 over claims 1, 2, 4-6, 8-12 and 14-17 of co-pending Application No. 10/509,752, Applicants respectfully request that this rejection be held in abeyance until one of the applications matures into a patent, at which time an appropriate terminal disclaimer for the still-pending application will be filed. However, at this time, Applicants would like to avoid the filing of a terminal disclaimer until such filing is absolutely necessary.

The rejection of claims 1-3, 5-7, 10, 11, 18 and 20-32 under 35 U.S.C. §102(b) as being anticipated by Vanderborgh et al (US Pat. No. 4,804,592) has been carefully considered but is most respectfully traversed in light of the following comments.

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Applicants wish to direct the Examiner's attention to MPEP § 2131 which states that to anticipate a claim, the reference must teach every element of the claim.

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). "The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). The elements must be arranged as required by the claim, but this is not an *ipsissimis verbis* test, i.e., identity of terminology is not required. *In re Bond*, 910 F.2d 831, 15 USPQ2d 1566 (Fed. Cir. 1990).

The Official Action urges that Vanderborgh discloses an electrode comprising an ion conducting material, an electron conducting material and an electrocatalyst and that this electrode is defined by Vanderborgh as a composite electrode having means for conducting ions, means for conducting electrons and an electrocatalyst. The Official Action states that this disclosure is considered to read on the claimed limitation "mixed conductor in the form of a single material". Applicants specifically traverse this statement.

Applicants have carefully considered the entirety of the Vanderborgh reference, and respectfully submit that the composite electrode disclosed therein cannot reasonably be interpreted as a mixed conductor in the form of a single material as claimed in the present application. This is mainly because Vanderborgh refers to the electrode disclosed therein as a "composite" electrode. As is well understood in the art, the standard definition of the word "composite" or the term "composite material" is an engineered material made from two or more constituent materials that remain separate and distinct on a macroscopic level while forming a single component. A common example of a composite is concrete, which normally consists of sand, conglomerate gravel, pebbles, broken stone, or slag in a mortar or cement matrix. Therefore, as Vanderborgh refers to the electrode disclosed therein as a composite electrode,

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Applicants respectfully submit that the composite electrode is made of many materials that are not combined to form a single material, but rather are distinct components mixed together but having no structural interaction. Such a composite material is clearly distinguishable from the mixed conductor claimed in the present application, which is expressly recited as being in the form of a single material. This is clearly set forth throughout the specification and illustrated in Figures 1, 2 and 3 of the instant application.

For these reasons, Applicants respectfully submit that the composite electrode disclosed in Vanderborgh does not disclose every element of the presently recited claims, and therefore is incapable of supporting a proper §102(b) rejection according to the guidelines set forth in MPEP §2131. In light of this, Applicants respectfully submit that this rejection be withdrawn.

To further support the position that the composite electrode disclosed in Vanderborgh is not in the form of a single material, Applicants draw attention to, e.g., col. 8 of the Vanderborgh reference, wherein the composite electrode illustrated in Figure 2 is described in detail. The composite electrode may be formed of three separate layers of zones as illustrated in Figure 2. Each layer comprises a mixture of carbon black (serving as the electron conductive material), platinum or other electrocatalyst supported on carbon black, petrafluoroethylene (serving as a binder), and a suitable ionic conducting material. An example of the amount of each component present in each layer or zone is summarized in Table 1. The specification continues that "[e]ach zone is prepared by combining the constituents dispersed in a suitable dispersant... and spray drying a layer of the resulting dispersion on either the current collector or membrane" (emphasis added; see col. 8, lines 49-54). As is well understood in the art, a dispersion is a mixture in which fine particles of one substance are scattered throughout another substance. Thus, this portion of Vanderborgh again supports the position that the electrode is a composite of materials, or that each layer of the electrode is a composite of materials, and refutes the position that the composite electrode is in the form of one material as claimed in the present invention.

The Official Action makes specific note of the portion of Vanderborgh that discloses that the layers are thermally bonded together, and urges that this is considered to read upon the limitation "fixed together by covalent bonding". Applicants have considered this portion of the Vanderborgh reference, but respectfully disagree with the position that this discloses covalent bonding as the term is used in the present claims.

First, Applicants note that covalent bonding is a recognized term or art with a precise definition. Covalent bonding is well understood in the art to mean a form of chemical bonding characterized by the sharing of one or more pairs of electrons between atoms, in order to produce a mutual attraction, which holds the resultant molecule together. Thus, Applicants respectfully submit that Vanderborgh must specifically recite this type of bonding to read on the present claims.

Applicants also note that, as is well understood in the art, the thermal bonding process involves interlocking materials through the use of heat energy. Thermal bonding uses the thermoplastic properties of synthetic materials, such as the polytetrafluoroethylene used in each of the zones disclosed in Vanderborgh (see Table 1), to allow the synthetic material to serve as the binder material in a composition. The heat in the thermal bonding process softens the synthetic material and once the melting point has been reached, the synthetic material in contact with each other will form strong bonds that hold the material together. After the material is cooled, the bonding points will solidify and ensure sufficient product strength.

Because Vanderborgh discloses that polytetrafluoroethylene is used as a binder (see, e.g., col. 8, lines 18-19) in the zones and because none of the other materials used in the zones is likely to be capable of thermal bonding, Applicants respectfully submit that the portion of Vanderborgh disclosing thermal bonding is directed to the process of thermal bonding together the polytetrafluoroethylene (PTFE) components of each zone in order to create what Vanderborgh refers to as a "composite laminate". That is to say, the components dispersed in the PTFE binder do not chemically interact with each other upon thermal bonding, but rather only the PTFE binder is thermally

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bonded to the PTFE binder in other zones or layers, thus creating a composite laminate comprising the constituents disclosed in Table dispersed in thermally bonded PTFE.

This is clearly distinguishable from the claimed invention. The claimed invention specifically recites that the electron conductor portion and the proton conductor portion are fixed to each other by covalent bonding, inclusion or intercalation. Therefore, in order for Vanderborgh to read on the present invention, it would need to be evident that the carbon black covalently bonds with the ionic conducting material (e.g., Table 1 refers to polyperfluorosulfonic acid as the ionic conducting material). However, given the basic understanding of thermal bonding and the context given in Vanderborgh, it is apparent that the PTFE binder and not the electron conductive material or the ionic conducting material is thermally bonded. The constituents listed in Table 1 do not interact, but rather remain in a dispersion as expressly stated in Vanderborgh. In light of this, Applicants respectfully submit that Vanderborgh does not disclose bonding between the ionic conducting material and the electron conducting material as asserted in the Official Action. Therefore, Vanderborgh fails to disclose every element of the presently recited invention and cannot properly support a §102 rejection according to the guidelines set forth in MPEP §2131. Applicants respectfully request that this rejection be withdrawn.

Applicants have included with this response a summary of the inventive mixed conductor claimed in the instant application and a summary of the fuel cell configuration disclosed in the prior art in order to more clearly explain the present invention. The summary is included only for reference, but Applicants believe that the present invention will be more clearly understood upon considering the summary.

The rejection of claims 12, 13, 16, 17 and 19 under 35 U.S.C. §102(b) as being anticipated by Chen et al. (US Pat. No. 6,187,157) has been carefully considered but is most respectfully traversed in light of the following comments.

The Official Action urges that Chen discloses a method for producing a multiphase solid electrolyte ion transport membrane, the method comprising a first step of chelating metal ions into an aqueous or organic mixture comprising a polymerizable organic monomer or prepolymer plus a chelating agent; a second step of heating this

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mixture to a temperature sufficient to polymerize the polymerizable organic monomer or prepolymer in order to provide a liquid polymeric composition containing chelated metal or metal oxide particles; a third step of contacting the liquid polymeric composition containing the chelated metal or metal oxide with the granulated first phase and mixing to provide an admixture comprising the granulated first phase coated with the polymeric composition; and a fourth step of heating the admixture to combust the polymeric composition and uniformly deposit the particles of the metal or metal oxide onto the surfaces of the first phase granules. Applicants respectfully submit that this method is different from the method claimed in the instant application in several respects.

First, Applicants note that claim 12 recites that organic compound and the proton conducting material are polymerized. To the contrary, Chen discloses heating the mixture to polymerize the polymerizable organic monomer or prepolymer. No mention is made of polymerizing the metal or metal oxide with the monomer or prepolymer. Rather, it appears that the resulting composition comprises polymerized organic monomer or prepolymer with metal or metal oxide particles contained therein. That is to say, particles of the metal or metal oxide are dispersed in the composition but not polymerized with the organic monomer or prepolymer.

Secondly, the presently claimed method recites pyrolyzing the precursor obtained from polymerizing the organic compound and the proton conducting material. To the contrary, Chen discloses contacting the liquid polymeric composition with the first phase to create an admixture and then the admixture is heated to the point of combustion. Thus, Chen does not disclose pyrolyzing the precursor containing only organic compound and proton conducting material, but rather discloses heating an admixture comprising the granulated first phase, the liquid polymeric composition and the metal or metal oxide to the point of combustion.

Thirdly, Applicants note that claim 12 recites a first step of obtaining a high molecular precursor by polymerizing an organic compound having one of or both of a carbon-carbon double bond and a carbon-carbon triple bond. The Official Action makes no specific mention of where in the Chen reference such an organic compound can be

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found and a review of the reference by Applicants reveals no such compound. Without a clear disclosure that Chen discloses this feature of the claim, Applicants respectfully submit that the reference is incapable of properly supporting a §102 rejection.

Finally, Applicants note that the final product of the method disclosed in Chen is a membrane comprising a first phase that is a mixed conductor/electronic conductor and a second phase comprising particles of metal or metal oxide coating the surface of the first phase granules. Thus, it appears that the metal or metal oxide that was considered to read upon the proton conductor material of the claimed is not part of the first phase, i.e., mixed conductor/electronic conductor. Rather, the metal or metal oxide proton conducting material is coated on the first phase granules that make up the mixed conductor. Accordingly, it cannot be said that the mixed conductor is in the form a single material as claimed in the presently claimed invention. The presently claimed method recites, in essence, mixing the proton conducting material with the electron conducting material and the pyrolyzing both materials so that the product is a mixed conductor in the form of a single material. The ability of the conductor to conduct both protons and electrons is based on the presence of both the initial proton conductor material and the electron conductor material being present in the form of a single material in the final mixed conductor. Therefore, because the proton conductor material, i.e., the metal or metal oxide, is not part of the single material comprising the first phase mixed conductor disclosed in Chen, the prior art reference clearly fails to disclose every element of the presently recited claims.


Based on the above discussion, it is clear that Chen fails to disclose every element of the presently recited claims and therefore is incapable of properly supporting a §102(b) rejection according to the guidelines set forth in MPEP §2131. In light of this, Applicants respectfully request that this rejection be withdrawn.

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In view of the above comments and further amendments to the claims and drawings, favorable reconsideration and allowance of all of the claims now present in the application are most respectfully requested.

Respectfully submitted,

BACON & THOMAS, PLLC

By: 

Scott A. Brairton
Reg No. 55,020

625 Slaters Lane, 4th Fl.
Alexandria, Virginia 22314
Phone: (703) 683-0500
Facsimile: (703) 683-1080

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